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ChalkTalk: A Participatory Design Framework for Designing Resilient Sustainable Transportation Infrastructures

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ChalkTalk: A Participatory Design Framework for Designing Resilient Sustainable Transportation Infrastructures

by

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Dedication

This report is dedicated to anyone being honked at on the road, trying to cross a busy street, waiting in traffic, catching the bus, and wanting to make their commutes safer and easier.

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Abstract

ChalkTalk: A Participatory Design Framework for Designing Resilient Sustainable Transportation Infrastructures

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American cities looking to reduce car congestion, improve air quality, and increase safety on the road are focused on shifting car commutes to sustainable "human-scaled" transportation modes like biking, and walking. As studies show though, 51% of car commuters cite safety concerns for their reluctance to bike on the road. This feeling of safety is either created or impeded by the quality of cycling infrastructure. Due to declining federal and state funding for municipal transportation improvements, more and more cities are looking towards local tax-based funding options like mobility bonds to build this type of infrastructure. These bond packages require significant public input, communication, and buy-in. However, emerging transportation technologies like ride-hailing and micromobility, in addition to fraught histories of grass-roots advocacy, have challenged the way cities communicate with their neighborhoods and residents about sustainable transportation. Contemporary practices of holding open houses, utilizing online commenting systems, and partnering with local advocacy groups help to disseminate information, but still fall short in encouraging active participation and engagement from

the public, resulting in a failure to attract the 51% of commuters mentioned above. It is my hypothesis that public life studies, participatory democracy, and tactical urbanism are by nature methods of observation, ideation, and rapid prototyping and iterating respectively that can be used to adapt design thinking to the transportation sector. By using the *ChalkTalk* framework, designers, residents, and planning professionals alike can collaborate on an innovative way to capture evolving transportation patterns, and create a rich set of qualitative data that lays the groundwork for a better participatory design practice.

Keywords: design, urban design, design thinking, sustainable transportation, emerging transportation, transportation research, transportation planning, infrastructure, micromobility, tactical urbanism, participatory design, participatory democracy, public outreach, public input, bicycles, scooters, systems design, public policy, collaboration, codesign, commuting, commuter cycling, pedestrian

Table of Contents

List of Tables

List of Figures

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THE PROBLEM SPACE OF SUSTAINABLE TRANSPORTATION INFRASTRUCTURE

In April 2018, dockless scooters and bikes came to Austin, and the reaction was swift. The city impounded unlicensed vendors, quickly amended code, and initiated policies to govern the use of free-floating transportation devices (Weber 2018). This action forced a very public discussion about policy, safety, accessibility, public land, vendor cooperation, and right-of-way management. Media and the general public sounded off, both locally and nationally, criticizing the sudden presence of these devices on the road, sidewalks, and front lawns, as well as blocking accessible facilities and bus stops. In other cities, some even went as far as to vandalize scooters in an act of protest by cutting brake lines and throwing them into rivers (Kerr 2018).

But where were these devices to go? Where were they to park? What was the proper way to ride them and who is to blame for infractions? What was seen as an irresponsible nuisance to some, was arguably just an example of an emerging transportation mode that lacked a suitable infrastructure. This mismatch between transportation mode and infrastructure—which creates a barrier to adoption in addition to its misuse and misconception—is not restricted to dockless scooters. For decades, cycling advocates have fought for better infrastructural affordances on the road. As transportation continues to evolve and innovate, the demand for multi-modal, adaptable, and resilient transportation infrastructure grows with it.

In this report I will provide an overview of the challenges faced by cities in building infrastructure that supports emerging and sustainable modes of transportation, sample new innovative movements in creative collaboration with the public, and introduce a framework for how designers and non-designers alike can help cities build this type of infrastructure.

The Growth of Commuter Cycling

A national survey of commuters conducted by Dr. Jennifer Dill and Nathan McNeil at Portland State University assesses commuters' level of comfort on the road while riding a bike. The data groups respondents into four "cyclist typologies"—originally developed by Roger Geller at the City of Portland—and describes a scaffolded level of comfort with bike facilities (Dill and McNeil 2016, 90). The smallest two groups are labeled "Strong and Fearless" and "Enthused and Confident" making up seven and five percent respectively. "Strong and Fearless" cyclists are described as cycling without the presence of bike facilities such as lanes, shared road markings, or separated paths, while "Enthused and Confident" cyclists were willing to cycle on city streets alongside car traffic when dedicated lanes were present. The second largest group is labeled "No Way No How" and describes people with little to no interest in cycling due to terrain, ability, or simply lack of interest (City of Portland 2009,1). The largest group, however, comprising 51% of respondents, is "Interested but Concerned": cyclists who would like to ride their bike more often but don't because of safety concerns on the road. Cyclists in this group are fearful of sharing the road with car drivers without the protective facilities of barriers, lanes, or separation. (Dill and McNeil 2016, 99).

TABLE 3 Study Results Compared with Past Findings: Four Types of Cyclists' Breakdown

Type of Cyclist	Original Estimate, City of Portland[a] (%)	Portland Metro Area[b] (%)	National Metro Areas[c] (%)
Strong and fearless	<1	4	7
Enthused and confident	7	9	5
Interested but concerned	60	56	51
No way, no how	33	31	37

[a]Geller (*1*).
[b]Dill and McNeil (*2*).
[c]The authors' research.

Figure 1. Cyclist typology data from Dill, McNeil, 2016.

City governments are trying to get more of this "Interested but Concerned" group onto bikes and out of cars to reduce traffic congestion, improve air quality, and increase safety on the road. Bike master plans in many U.S. cities frequently mention this "Interested but Concerned" audience, and in some cases even replicate the same study with local data. In Austin, TX for example, "Interested but Concerned" actually ranked second largest at 40% of respondents (City of Austin 2014, 10). Nevertheless, transportation planners increasingly focus on "all ages and abilities" in the design of bike infrastructures in order to attract new cyclists in their city. These infrastructures include separated or protected bike paths, dedicated bike boulevards, or entire roads designed to slow car traffic, to name a few.

Funding road improvements for this audience comes with its own set of challenges. Very few federal and state transportation dollars are dedicated to local, non-motorized

transportation infrastructure. Today, this has led many cities to look toward local property or sales taxes, or mobility bonds backed by those taxes, to support desired infrastructure. Public buy-in is an essential step in securing these resources.

Less than 4% of the overall commuting population cycles to work (American Association of State Highway and Transportation Officials 2015), and in many cities like Austin the share of commuter cycling can be as low as 1%. There is much to be desired in these forms of measurements, however, as the American Community Survey, part the United States Census, only asks about commutes to work and only about the longest leg of those trips (United States Census). So, for someone who rides a bike one mile to a bus stop, takes the bus to another part of town six miles away, and bikes the remaining two miles, the bus trip would be the only trip logged and recorded in the data. This scenario shows how these measurements incompletely represent multi-modal transportation taken by city residents. Additionally, a study by the National Household Travel Survey (NHTS) shows that 48% of vehicle miles traveled in the U.S. are designated as "other resident travel," that is, household travel to everything else we do in our lives such as trips to doctors' offices, pharmacies, daycares, grocery stores, schools, coffee shops, restaurants, bars, post-offices, convenience stores, gas stations, music venues, sporting events, and so on (American Association of State Highway Transportation Officials 2015, 9). Planners have historically designed transportation infrastructures to support commuting; however, as the NHTS data show, most travel is not commuting, so ideally, transportation would be planned to support those other kinds of trips, too.

Table ES-1. Auto Commuting in Perspective

	Percent of VMT
Household Travel	
Commuting	21.1%[a]
Work-Related/Business Travel	6.8%[a]
Other Resident Travel	48.1%[a]
Public and Commercial Travel	
Public Vehicle Travel	2.0%[b]
Utility/Service Travel	12.0%[c]
Freight and Goods Movement Travel	10.0%[d]
Total	**100.0%**

Sources: NHTS 2009, FHWA State Statistical Abstracts, FHWA

[a] FHWA estimate based on NHTS data.
[b] FHWA estimate using vehicle registration data.
[c] FHWA estimate based on HPMS data and NHTS.
[d] FHWA estimate based on HPMS data.

Figure 2: Commuting data from AASHTO, 2015.

Due to this skewed way of measuring transportation behavior in America, gaining public buy-in for sustainable transportation infrastructure for cycling presents a challenge for nearly all U.S. cities whose residents do the majority of their traveling by car. In addition to discouraging the latent majority of those who would cycle if they felt safer on the road, this way of reporting data also makes cycling seem less prevalent than it really is., relegating it to the status of a hobby or childhood past-time at best, and a needless and dangerous addition to the roads at worst.

The Role of Infrastructure in Sustainable Transportation

THE COST OF SUSTAINABLE TRANSPORTATION INFRASTRUCTURE

As Dill's survey has shown, getting more people to commute by bike requires a larger investment in safe infrastructure. While the cost of bike infrastructure per mile can be significantly less than highways or streets, infrastructure enhancements to existing city roads can still be a costly and time intensive process to design and build. A review of the costs for bicycle infrastructure improvements shows the basic level of bicycle facility such as a shared lane marking or "sharrow" (useful for "Strong and Fearless" or "Enthused and Confident" riders) costs on average about $180 per stenciled marking. Referring to the Urban Bikeway Design Guide* created by the National Association of City Transportation Organizations (NACTO), sharrow markings should be added to a city street every 100 feet on average, resulting in a cost per mile of $9,504. A dedicated bike lane like those seen in many U.S. and European cities (useful for attracting potential "Interested but Concerned" riders) can cost an average of $133,000 per mile, and increased amenities meant to improve the feeling of safety such as bollards, chicanes, or separated multi-use paved paths can increase costs further (Bushell, Poole, Zegeer, and Rodriguez 2013, 42-43).

* The Urban Bikeway Design Guide has become a standard manual for bike facility design for many U.S. cities, and is also a required resource for many federal grants funding alternative transportation.

Infrastructure	Description	Median	Average	Minimum Low	Maximum High	Cost Unit	Number of Sources (Observations)
Bicycle Parking	Bicycle Locker	$2,140	$2,090	$1,280	$2,680	Each	4 (5)
Bicycle Parking	Bicycle Rack	$540	$660	$64	$3,610	Each	19 (21)
Bikeway	Bicycle Lane	$89,470	$133,170	$5,360	$536,680	Mile	6 (6)
Bikeway	Concrete Bicycle Path	$182,870	$179,340	$91,420	$343,700	Mile	2 (6)
Bikeway	Signed Bicycle Route	$27,240	$25,070	$5,360	$64,330	Mile	3 (6)
Bikeway	Signed Bicycle Route with Improvements	$241,230	$239,440	$42,890	$536,070	Mile	1 (6)
Bollard	Bollard	$650	$730	$62	$4,130	Each	28 (42)
Chicanes	Chicane	$8,050	$9,960	$2,140	$25,730	Each	8 (9)
Pavement Marking Symbol	Shared Lane/Bicycle Marking	$160	$180	$22	$600	Each	15 (39)

Figure 3: Cost tables for bicycle facilities. Data from Bushell, Poole, Zegeer, and Rodriguez, 2013.

PUBLIC PARTICIPATION IN TRANSPORTATION INFRASTRUCTURE

Public participation and transportation have gone hand-in-hand for quite a while. The advent of paved roads in the United States came from advocacy efforts of cyclists. At the time, roads were no more than dirt paths or cobblestone streets suited for horse-drawn carriages. The unforgiving nature of early bicycle designs led to an outcry of support behind paved roads.

One of the most famous historical cases of public participation in transportation could be the highway revolts of the 1970s. During the post-war economic boom in the United States, highways and the personal automobile were seen as the future of connectivity and growth. With a car a person could easily and conveniently travel from door to door and the highway would provide this mobility through the use of moldable,

durable reinforced concrete. Funded by the Federal Highway Act of 1956, the interstate highway system was originally born as a line of defense to move military trucks and equipment across the nation in times of emergency. For the latter half of the twentieth century, highways were a key catalyst in advancing urban sprawl and rapid "de-urbanization" (that is, more people living in suburbs and commuting into city centers) of American cities (Muller 2017).

When these highways met city limits, however, transportation engineers had to decide which neighborhoods these roads would go through. Highways at this scale had enormous footprints and therefore needed large amounts of land to support them. However, the areas of land that were picked for demolition and subsequent construction were commonly disenfranchised ethnic and minority neighborhoods. Two of the most infamous cases were San Francisco's Embarcadero Freeway (Carlsson) and New York's Cross-Bronx Expressway (Caro 1974, 850)

Similarly, the growth of cycling in the United States also coincided with the rise of advocacy in cycling. This movement can be traced back to the gas shortages of 1973. A global oil embargo incited by The Organization of Petroleum Exporting Countries (OPEC) in response to countries supporting Israel during the Yom Kippur War (Charles D Smith 2006, 329), caused severe hikes in gas prices and all but emptied U.S. highways and roads of cars. Many environmentalists, particularly in Davis, California, where a strong bike culture had already taken root, took this opportunity to advocate for an alternative form of transportation that didn't rely on foreign sources of oil: the bicycle (Mapes 2009, 36). This groundswell continued throughout the 1980s and 1990s as oil sourcing and climate change became perpetual topics in political discourse (Mapes 2009, 37).

What these two examples in grass-roots advocacy in transportation have in common is their ability to organize a group of people around a central cause, and demonstrate the

need for local governance in transportation funding. These efforts led to major political wins year after year, president after president, and congress after congress, establishing bills and institutions that have become major influencers in regional and local transportation issues. Notable federal transportation funding bills such as the Intermodal Surface Transportation Efficiency Act in 1991, and the Moving Ahead for Progress in the 21st Century Act in 2012, have each earmarked an increasing share of federal funds for local transportation initiatives meant to reduce single-car occupancy commutes (Fields and Craddock 2014, 324-325). Particularly of interest is the establishment of Metropolitan Planning Organizations (MPOs) by the federal government in the wake of the highway revolts as a governing body of policy-makers and transportation professionals who have specific direction to involve the public in regional and local transportation planning processes (FHWA Metro Transportation Planning Briefing Book).

Policy, however, can only move the needle so far. While these movements have encouraged the development of sustainable transportation infrastructure and require public participation in the planning process, they do not provide guidance about *how* to engage the public in participation in order to sustain this funding. In fact, in more recent history, federal investment in alternative transportation has begun to decrease due to "strong constituencies in Congress," all the while retaining strict requirements for public participation in planning (Fields and Craddock 2014, 325). These constituencies could signal the presence of stronger lobbying against sustainable transportation funding, resulting in increased challenges for cities to build connected network of infrastructure.

In *Searching for the Good Plan: A Meta-Analysis of Plan Quality Studies for MPOs,* Philip Berke and David Godschalk provide a system of rating and review for local and regional strategic plans. In the paper they studied sixteen different regional plans of various cities and rated them on the criteria of issue identification, fact base, public-defined

goals, policy, internal consistency, implementation, monitoring, presentation to the public, coordination with other organizations, and regulation compliance (Berke and Godschalk 2009, 230). Their evaluation of these plans shows high scores with regulation compliance, issue identification, implementation measures, and monitoring indicators. However, many plans scored lower on fact bases, public-defined goals, and presentation to the public. This could reveal a deficiency in the process of working with the public in: a) an accurate measure of demographics that serve as the basis of decision-making; b) identifying the collective transportation goals of the population it seeks to serve; and/or c) the manner in which these goals are communicated and broadcasted (Berke and Godschalk 2009, 238).

Table 3
Summary of Findings for Internal Characteristics of Plan Quality

Investigators	Issue	Fact Base	Goal	Policy	Internal Consistency	Implement	Monitor and Evaluate
1. Burby and May 1997							
Mandated plans	.26	.34	.13				
Nonmandated plans	.05	.09	.03				
2. Berke et al. 1997							
New Zealand		.13	.68	.11			
Florida		.45	.53	.23			
3. Deyle and Smith 1998							
4. Berke et al. 1999							
Local plans	.47	.06			.66		.39
Regional plans	.61	.12			.62		.21
5. Godschalk et al. 1999		.24	.33	.24		.24	.24
6. Berke and Manta-Conroy 2000							
Sustainable development				.32			
Nonsustainable development				.36			
7. Berke et al. 2002	.44	.15			.60		
8. Nelson and French 2002		.21	.18				
9. Brody 2003							
t_1 = 1991		.09	.10	.05			
t_2 = 1999		.12	.13	.12			
10. Brody et al. 2003a, 2003b		.22	.37	.44		.58	
11. Brody et al. 2004		.25	.36	.42		.30	
12. Norton 2005		.65	.62	.69	.62	.67	.58
13. Brody et al. 2006				.12			
14. Termorshuizen et al. 2007		.30	.16	.87			
15. Hoch 2007		.47		.14			
16. Edwards and Haines 2007			.67	.22			
Overall means[a]	.48	.23	.31	.25	.63	.44	.38
Standard deviation	.06	.16	.19	.24	.02	.19	.15

a. Overall means are weighted based on sample size of each study.

Figure 4. Plan quality rating tables for first eight criteria. Data from Berke, Godschalk, 2009

Table 4
Summary of Findings for External Characteristics of Plan Quality

Investigators	Organization and Presentation	Coordination	Compliance
1. Burby and May 1997			
2. Berke et al. 1997			
3. Deyle and Smith 1998			.44
4. Berke et al. 1999			
Local plans	.48	.43	.35
Regional plans	.37	.46	.65
5. Godschalk et al. 1999		.23	
6. Berke and Manta-Conroy 2000			
7. Berke et al. 2002			.70
8. Nelson and French 2002			
9. Brody 2003a			
10. Brody 2003b		.51	
11. Brody et al. 2004		.43	
12. Norton 2005			
13. Brody et al. 2006			
14. Termorshuizen et al. 2007		.74	
15. Hoch 2007			.91
16. Edwards and Haines 2007			
Overall means[a]	.44	.46	.63
Standard deviation	.05	.17	.21

a. Overall means are weighted based on the sample size of each study.

Figure 5. Plan quality rating tables for remaining three criteria. Data from Berke, Godschalk, 2009.

The Role of Public Participation in Planning Sustainable Transportation Infrastructure

FORMS OF PUBLIC PARTICIPATION

There are of course other forms of public participation with governing bodies. One most often used in transportation planning is public forums and open houses. These events are commonly held at institutional venues that provide central, publicly accessible open spaces such as city halls, libraries, elementary schools, or recreation centers. Proposed plans detailing the addition and form of bike lanes, reduction in on-street car parking, or new road enhancements like sidewalks and crosswalks are displayed on large maps. In the case of the Austin Strategic Mobility Plan (ASMP), funded by the local mobility bond, the public was invited to add comments to selected areas of improvement through sticky notes or to vote on proposed enhancements with stickers or push-pins. Transportation professionals working for the city are also present to engage people in conversation and answer any questions they may have. While the city does its best to accommodate as much input as they can through this style of engagement, these meetings can have low-turnout due to time and location constraints. And though these approaches are good for providing an easy and quick way for people to provide feedback, the feedback garnered can be more reactive than proactive and participatory, particularly when engineers and designers have already drawn up initial plans.

Figure 6. Austinites participating in public input event. Photo from *CodeNEXT Listening to the Community Report*, 2014.

I spoke with a representative of the city proctoring one these meetings for the ASMP in a neighborhood library in November, 2018. I learned that roughly ten people per one-hour session would stop to look at the plans, but about half of these were advocates or people already engaged in public infrastructure such as avid cyclists and public transit supporters ("Eric" 2018). Only about 10% were already familiar with the ASMP. This was sobering as the initiative was already in its penultimate third stage. Of the remaining 90% of people who were not familiar with the ASMP, topics of discussion normally focused around elements not included in the plan, such transit improvement (which is under the jurisdiction of the Transit Authority) or dockless scooters (which were still a new and growing form of mobility).

Another form of public input is online voting and commenting on a plan. This can take the form of using both proprietary online software, or social media such as Facebook or Twitter. The benefit of this type of input is that it has the potential to reach a large percentage of residents in a community, and easily allow for city staff to aggregate and analyze responses. To gauge the efficacy of online approaches, I spoke to two planners who often administer them for city plans. In an interview with a town planner for the Town of Normal, Illinois, I learned that online systems were least valued in assessing public need for transportation projects for the reasons of anonymity, credibility, and disconnection between residents and city staff. This division had the consistent effect of encouraging divisive or one-dimensional comments, or attracting fringe interest groups like advocates from whom they already have feedback or work with on a frequent basis (Davison 2018). In another interview, a transportation planner for the City of Austin said that conducting online surveys was effective in reaching a large number of people, but gaining qualitative feedback on plans was best done face-to-face. Also citing the issue of anonymity, this planner mentioned that filling out an online survey doesn't instill the participant with as much pride as speaking directly to a city official. While online media can provide access to a large amount of people, but can be problematic in acquiring qualitative feedback (Cook 2018).

A third form of public input is speaking before city council, which can have a unique benefit of putting one's opinions directly in front policy-makers and occasionally local media. Drawing upon my personal experience in cycling advocacy, these benefits were best suited for council sessions where major policy or infrastructure decisions were to be discussed or voted on. Likewise, those with opposing viewpoints would use the same venue as well.

All three of these public input models share some common threads: they all take place in city-owned venues which ask the public to come to them, and the type of feedback received tends to be largely reactionary to pre-developed plans with little prior participation from the public. Overall these methods are successful at disseminating information to the public at large, but still seem to fail at educating and engaging the public on benefits of sustainable transportation infrastructure investments, soliciting good ideas from the public, and empowering the public to affect the decision-making process.

Cycling Advocacy

Another form of public participation as it relates to sustainable infrastructure comes in the form of cycling advocacy. The League of American Cyclists (formerly known as the League of American Wheelmen), the oldest and longest running cycling advocacy organization in the United States, operates out of Washington, D.C. and serves as a strategic leader in federal lobbying efforts for cycling infrastructure. The organization also ranks states, communities, businesses, and universities based on their "bicycle friendliness," one criterion of this being the presence of an active bike advocacy group. According to their website, over 130 cities in the U.S. have an active bike advocacy organization, and this does not include advocacy groups that operate on the state level, or within universities. In a Wikipedia entry "List of United States Bicycle Advocacy Organizations," 147 individual organizations are listed across 43 states and Puerto Rico. It is safe to estimate there is at least a handful of advocacy organizations in each region of the U.S.

THE LIMITATIONS IN CYCLING ADVOCACY

While cycling advocacy has made tremendous strides in advancing support behind cycling infrastructure, it can also be susceptible to misunderstanding or misrepresenting the needs of "Interested but Concerned" riders. Speaking from personal history as a founder of one of these organizations, volunteers and activists who take leadership roles tend to be within the "Strong and Fearless" or "Enthused and Confident" typology of bike rider (myself included). This makes sense as usually the most ardent and dedicated cyclists would offer their skills and time toward such endeavors. There are of course exceptions that exist and most leaders of advocacy organizations would attest to their commitment to

creating a cycling environment for all riders of age and ability. However, advocacy is a game of politics as much as it is an act of social betterment. For example, while working as a board member for Bike BloNo in Bloomington-Normal Illinois, our group frequently met with apprehension from policy-makers when we sought to remove parking in order to install a bike lane on a city street. A common compromise to keeping on-street parking but providing some level of comfort for cyclists is installing a shared-lane marking or "sharrow." This was seen as a political win as it increased the number of bikeways in the community. However, as Dill and McNeil's research in cyclist typologies have shown, this level of infrastructure only encourages the strongest of riders and not the largest majority of potential riders.

This is not to say that advocacy is not worthwhile or doesn't provide iterative steps towards more dedicated and safer infrastructure. As more "Enthused and Confident" riders take to the streets, and as cycling becomes more visible to the public, it becomes easier to make a strong case for more dedicated infrastructure. But relying too much on advocacy groups' input—because advocacy groups are largely composed of "Enthused and Confident" and "Strong and Fearless" riders—can create bias in decision-making toward the strongest, most committed riders, when what is needed is infrastructure efforts directed at less confident riders.

Innovation in the Transportation Sector

The Emergence of Micromobility

Dockless scooter and bike companies such as Lime, Bird, Jump, and Spin, to name a few, took an aggressive but effective approach to entering new markets in cities by releasing hundreds and sometimes thousands of scooters onto public streets. Many cities reacted like Austin by quickly impounding these devices over fears of safety, but soon amended (and continue to amend) policy to make them legal forms of transportation.

In addition, a very public backlash continued against these devices due to improper parking and safety. Social media was flooded with photos of scooters in front of accessible ramps, doorways to buildings, bike racks, sidewalks and front lawns. Hospitals in Austin reported an increase in head injuries from scooter falls due to the helmet-free nature of rentable transportation.

How these devices were legalized varied from city to city. In Austin, dockless scooters were to share the road with other cars and, when present, with bikes in a bike lane. In Denver, however, scooters were regarded by state law as "toy vehicles" and therefore could only be operated on sidewalks, never in the road or bike lane.

Another area of market growth in transportation is electric-assist bikes, or e-bikes. At the time of this writing, e-bike development has been announced by major companies such as Ford, GM, and Harley Davidson, who are likely to engage in significant lobbying efforts to develop transportation infrastructure to suit their interests, which may or may not be beneficial to cyclists and scooter riders.

These forms of rentable, shared transportation modes have been grouped with other existing human-powered modes like bicycles and skateboards and given the moniker of "micromobility" by transportation planners and media.

DOCKLESS SCOOTERS: A CASE STUDY

One of the key benefits of having a rentable dockless transportation system in a city, in addition to providing an often-sought last mile solution for transit connectivity, is providing easy and cheap mobility for visitors and tourists. During a visit to Denver in November, 2018, I used a dockless scooter to get between downtown locations and my AirBNB in the River North (RiNo) district. Instinctively, I comfortably rode in the bike lane for the entire trip, only realizing afterwards that the sidewalk was the mandated corridor for Denver. There were no signs, no pavement markings, and no indication within the scooter renting app that I was to use the sidewalk.

Bike advocates, commuters, and cyclists I have spoken to in Austin during community bike events like Hottest Day of the Year and Bike to Work Day have expressed apprehension and at times indignation about the arrival of scooters in bike lanes. Concerns over speed were often mentioned, citing that the speed of scooters was much slower than that of cyclists. This was a relative but ultimately untrue claim as cyclists tend to move at their own pace, however at the time of the interview dockless scooters could reach a top speed of around 17mph, a speed that is quite often only achieved and maintained by endurance cyclists. Scooter users were also referred to sarcastically as the "cool kids," a slight that I interpreted as both dismissal of a temporary trend as well as resentment towards its fast and visible adoption within the city.

There were also supporters of dockless scooters in Austin, who saw these devices as a critical step in diversifying modes and human-scaled activity on the road. But as the examples above show, there is little consistency in how these devices are governed, or how a person should appropriately use them in a given city.

THE RISE OF RIDE-HAILING

Scooters were not the first mode of transportation to move into a city uninvited. Uber and Lyft reinvented the ride-hailing service seemingly overnight. Using turn-by-turn GPS technology and the proliferation of personal vehicles on the road, these companies successfully innovated the taxi-cab model by making the process of hailing a ride easier, more reliable, and faster for the end user than calling established cab companies.

However, ride-hailing companies have been criticized for their lack of background check of drivers and inadequate pay and benefits, because they "contract" drivers rather than hiring full-time employees, and provide poor information security on behalf of the user (aspects that were, for the most part, core promises to the public by unionized cab companies). At the time of this writing, Uber and Lyft drivers are staging strikes in many U.S. cities to protest unfair wages, a move that coincides with these companies record-setting public offers (Shaban 2019). Some cities have banned Uber and Lyft for either security or monopolistic reasons, or for increasing the number of idling cars on city streets. In 2016, Uber and Lyft exited Austin over a requirement that drivers be fingerprinted and run through an FBI background check. In its wake, other compliant ride-hailing companies such as RideAustin and Fasten filled the void. However, only a year later, state legislation overrode the fingerprint ban, allowing the companies to return (Kravets 2017).

This new model of ride-hailing has also spawned new reinventions of mass transit. Uber Pool and Ford's recent experiment in private ride-sharing, Chariot, offers the ability to share rides with other users, a service akin to airport shuttles and on-demand mass transit.

TRANSPORTATION-AS-A-SERVICE IN THE PRIVATE SECTOR

One of the most surprising shifts is the recent movement by Ford to reinvent itself as a mobility company rather than a traditional automaker. Their new CEO has made public

statements affirming this move which has been followed up by their support for bike share systems in San Francisco, autonomous vehicle manufacturing, and support of non-car-centric city planning.

Comparing these major shifts in transportation technology with the inability of cities to foster and support alternative modes shows that innovation in the transportation sector is happening much faster than infrastructure can be built to meet it. In addition, it may signal an increasingly privatized model for transportation funding that blurs the line between private innovation and public infrastructure.

NEW MODELS OF PUBLIC PARTICIPATION

In recent decades, new forms of public participation have been created that strive to educate and empower everyday residents in processes of the built environment that go beyond simple communication and feedback. In this section I will discuss a few of those most relevant to my research as they operate within the arena of design, urban planning, and sustainable transportation.

Public Life Studies

Starting first in the realm of urban design and architecture, demonstrations like those of the highway revolts in the 1960s and 70s spawned a new appreciation for the messy realities of public urban life. Activists and researchers like William Whyte, Jane Jacobs, and Jan Gehl stood in opposition to the planned communities popular in the first half of the twentieth century. These movements in urban planning strived for what they called "urban renewal," which meant displacing residents of disenfranchised neighborhoods in the name of civic renewal, harmony, and aesthetic unity (Bluestone 1988). The concepts of the "garden city," "city beautiful," and "radiant city" pioneered by Ebenezer Howard, Daniel Burnham, and Le Corbusier, respectively, focused on organized highways and centers of isolated monumental constructions (Jacobs 1961, 24). Jacobs, in her now seminal book *The Death and Life of Great American Cities,* identifies these ideologies—built around the promise of automobile-powered freedom—as catalysts of the urban renewal programs that fueled the aggressive growth of highway construction and their subsequent demolition of city neighborhoods regarded as "slums" (Jacobs 1961, 4). Based on her direct observation of city sidewalks, Jacobs also argued that density and pedestrian activity, as well as the complex relationship between streets, neighborhoods, and cities, were key factors in neighborhood and city safety.

Two other influential researchers, Jan Gehl and William Whyte, also used what they called “public life studies” to inform urban planning in the late 1960s and early 70s. Both developed methods of observing and documenting human movements in built environments in order to find and quantify patterns of how people moved through public spaces (Whyte 1980, Gehl 2013). Jacobs’, Gehl’s, and Whyte’s approaches marked a turning point in urban planning from the “visionary planner” approach toward more local, collaborative, human-centered, and grass-roots approaches to city planning—the same approaches that can be seen today in design.

Tactical Urbanism

Another growing form of public participation pertaining to sustainable transportation is tactical urbanism, a term first coined by urban planner Mike Lydon. On the official website tacticalurbanismguide.com, it is described as "flexible and short-term projects to advance long-term goals related to street safety, public space, and more" (Tactical Urbanism Guide n.d.). Basically, tactical urbanism is guerilla actions taken by individuals or groups (rather than governmental agencies) to modify public infrastructures, including transportation infrastructures.

The benefits of tactical urbanism are its aggressive and grassroots nature. The goal of tactical urbanism is to show the impact an intervention in the built environment can have on public life, in order to make governing bodies take notice and amend a law, policy, or de-facto rule that impedes the desired result from taking root. Examples of tactical urbanism include pop-up bike lanes, small spaces of leisure known as "parklets," improvised crosswalks, and the way that dockless scooters and ride-hailing companies emerged in cities. It is a version of the "act first, seek permission later" strategy.

There are numerous examples of tactical urbanism in the world, but some of the more creative blend public art with infrastructure. One notable example is pedestrian crosswalks. The familiar white stripes that denote where pedestrians can safely cross the street, often referred to as "zebra striping," have become so commonplace and routine that they sometimes fail to grab the attention of a car driver. To slow down car traffic and thus make the crosswalk safer to pedestrians, local activists have augmented the white stripes with artwork, color, and illusionistic (sometimes anamorphic) imagery.

There is not yet enough research to tell if these augmentations are successful, apart from direct observation. What is at work with these augmentations, though, is a break in

the routine of commuters. In his book *Thinking Fast and Slow,* Daniel Kahneman studies the processes at play in the human brain and how external stimuli can influence decision-making and attention. To summarize, he characterizes the human brain as having two basic systems of cognition: System 1 is automatic and intuitive; System 2 is effortful and arithmetic (Kahneman 2011, 21). For much of our daily lives, such as commuting to and from work along a routine path, System 1 tends to take control. However, when something new, challenging, or surprising happens before us, a splash of color on an otherwise familiar gray road, perhaps, System 2 "awakes" to process the new information. Kahneman writes "you can feel a surge conscious attention when you are surprised" (Kahneman 2011, 24), and it is this type of attention that is the goal of interventions such as crosswalk enhancements. It not only serves as a way to *remind* car commuters of the presence of a crosswalk, but also to *think critically* about the role that crosswalks, pedestrians, cars, and car drivers play in the built environment.

Tactical urbanism used to be a low-cost, low-risk, grass-roots, and often subversive strategy used by people who were not planners to intervene in the built environment. But tactical urbanism is becoming more mainstream in institutions, too. For example, the Oklahoma Department of Transportation gained approval from the Federal Highway Administration to test three-dimensional crosswalks over a two-year period (Hampton 2014). During my aforementioned visit to Denver, I also noticed bike lanes in the RiNo district featuring its mascot rhino riding a bike, rather than the typical cyclist stencil, and many intersections featured crosswalk art, responding to the district's *de facto* designation as an art district. These small amenities created an immediately inviting facility for an out-of-towner to bike, walk, and scoot.

Figure 7. “Rhino” bike lane in RiNo District, Denver, CO.

Looking to the world of design agency work, Human Scale Studio is a tactical urbanism and intervention firm located in Detroit, Michigan. Started by Chad Rochkind, it is an urban design firm that “provide[s] people-centric solutions to cities, neighborhoods, and social impact organizations” (Rochkind 2019). One of the projects featured on the firm’s website documents a parklet that was installed outside a coffee shop on Michigan Avenue, a notoriously wide stretch of road along a business corridor in Detroit. The parklet received immediate attention from both patrons and the city. While the parklet was eventually dismantled by city staff, the effect it had in demonstrating “what could be” had already made an impact. The result of the small experiment led to the creation of a protected bike lane along Michigan Avenue.

Figure 8. Michigan Avenue Parklet. Photo from Rochkind, Accessed on May 8, 2019.

During a phone interview with Rochkind, I learned the parklet was originally intended to provide seating for the patrons of the coffee shop, who had previously been perching atop milk crates on the sidewalk. The studio employs design thinking methodologies for all their projects, and observation was a key step in determining how people move through and used a specific space.

Another successful project demonstrating the possibilities of tactical urbanism in the realm of urban planning is *Pop Up Meeting* in St. Paul, Minnesota, by artist Amanda Lovelee. Hired as a city artist through the Public Art St. Paul program, Lovelee's installation creates a public input meeting out of a retrofitted truck, effectively bringing

meetings about urban planning to the streets of neighborhoods in which they are intending to improve. City residents received locally made popsicles in exchange for survey responses and feedback on proposed plans. The responses were then shared publicly and immediately to help determine what the focus of the meetings in each place became (Lovelee 2018).

Figure 9. Popup Meeting. Photo from Lovelee, Accessed on May 8, 2019.

The mobility of pop-up meetings, generally, is a demonstration in placemaking and borrows from a well-established method in public life studies and design thinking, the intercept interview, in which researchers stop random people on the street to ask one or two quick questions. Pop-up meetings allow for place-specific public input meetings to occur. Likewise, while there is often a prompt for discussion and feedback similar to the ones at the public meetings mentioned above, pop-up meetings bring these topics to the people rather than asking them to come to a meeting at City Hall. This approach to a public meeting utilizes the small-scale testable ethos of tactical urbanism and the analogy of a food truck to effectively engage a broader segment of the public on issues of urban planning.

Yet another example of tactical urbanism as a method in the design process comes from the Better Block Foundation, whose mission is to empower community members to improve their neighborhood infrastructure. In an interview with Managing Director Krista Nightengale, I learned that the organization started with more interventionist and subversive roots, but has now begun to work more and more with city governments. This has been a result of gaining measurable effects and credibility through past tactical urbanism projects, and their ability to mobilize and facilitate active participation from city residents (Nightengale 2018).

LIMITATIONS OF TACTICAL URBANISM

One of the limitations of tactical urbanism, however, is its temporary and disruptive nature. Since tactical urbanism seeks to show the public "what could be," it necessarily positions itself in opposition to the status quo, and therefore will disrupt routines and expectations. This can be an effective method if the potential benefits are as clear as they were with the parklet and pop-up meeting examples above. However, in cases where the installation is only a hindrance and of little obvious benefit, tactical urbanism can be counterproductive, because it undermines the credibility of the method and the people making the intervention. A brief review of tactical urbanism manuals suggests that projects should be chosen carefully in order to create the most impact (Tactical Urbanist's Guide 2016, Asakura Robinson 2017, 26).

In addition, the recommended solutions found in these manuals can be repetitive and formulaic: almost all of them recommend using tactical urbanism to create pop-up bike lanes, parklets, and enhanced crosswalks. While the manuals all seem to support observation and human-centered inspiration, the repetitiveness of these solutions highlights a need for more generative solution finding through creative and collaborative thinking.

Participatory Democracy and Design Thinking

As mentioned above, attaining public input is a requirement for both federal and local funding of sustainable transportation infrastructure. But most cities rely on traditional City Hall meetings to elicit public input, which is not always effective, for the reasons described above. Additionally, a recent report by the Pew Research Center shows that American trust in government is at a fifty-year low and has remained there since 2007 (Pew Research Center 2019). In their book *Public Participation for the Twenty-first Century*, Tina Nabatchi and Matt Leighninger hypothesize that this lack of trust could be attributed to a growing sense of disconnection with government, i.e., that people no longer think their voices are being heard or that they have the ability to make an impact (Nabatchi and Leighninger 2015, 6).

However, there are some effective examples of how to engage the public in discussions about infrastructure, and interestingly, many of them share strategies with design thinking. The contexts in which they were created were increasing governmental dissatisfaction, institutional inequality, and growing concerns over the future of public services. For example, the Kettering Foundation has a long-standing history of research into the practice of democracy and citizen activation. In *Developing Materials for Deliberative Forums,* Brad Rourke, program officer at the Kettering Foundation, outlines steps for creating an "issue guide" to help inform and empower public deliberation on divisive issues by "naming and framing" issues (Rourke 2014, 3). This naming-and-framing process is analogous to the "problem framing" or "problem definition" stage in most design thinking methodologies.

Table 1. A comparison of Deliberative Forum steps by Rourke and selected Design Thinking steps by IDEO.org

ROURKE	IDEO.ORG
The Framing Team	Frame Your Design Challenge/Build a Team
The Topic	Create a Project Plan
Research	Secondary Research
Gathering Public Concerns	Interviews/Define Your Audience/Immersion
Grouping Like Concerns	Find Themes
Values and Things Held Valuable	Create Insight Statements
Describing the Options	Explore a Hunch/How Might We/Brainstorm

Source: Data from Rourke, 2014, and IDEO.org, 2015.

In another example, the National Center for Dialogue and Deliberation documents in their Engagement Streams Framework four separate streams of engagement: Exploration, Conflict Transformation, Decision Making, and Collaborative Action (National Center for Dialogue and Deliberation 2013, 2). While these streams are not intended to be utilized in succession, it's easy to see another parallel to the design thinking steps of Inspiration, Ideation, and Implementation.

Lastly, in the *Facilitator's Guide to Participatory Decision Making*, Sam Kaner introduces a realistic model for visualizing how groups come to decisions about tough problems when conventional decision-making strategies fail. Their final model is a diamond-shaped diagram that contains both divergent and convergent thinking methods. They refer to the middle, wide part of the diamond as the "groan zone": the point in the process when groups find themselves drifting further from the original starting point in a quest to find innovative solutions (Kaner 2014, 19).

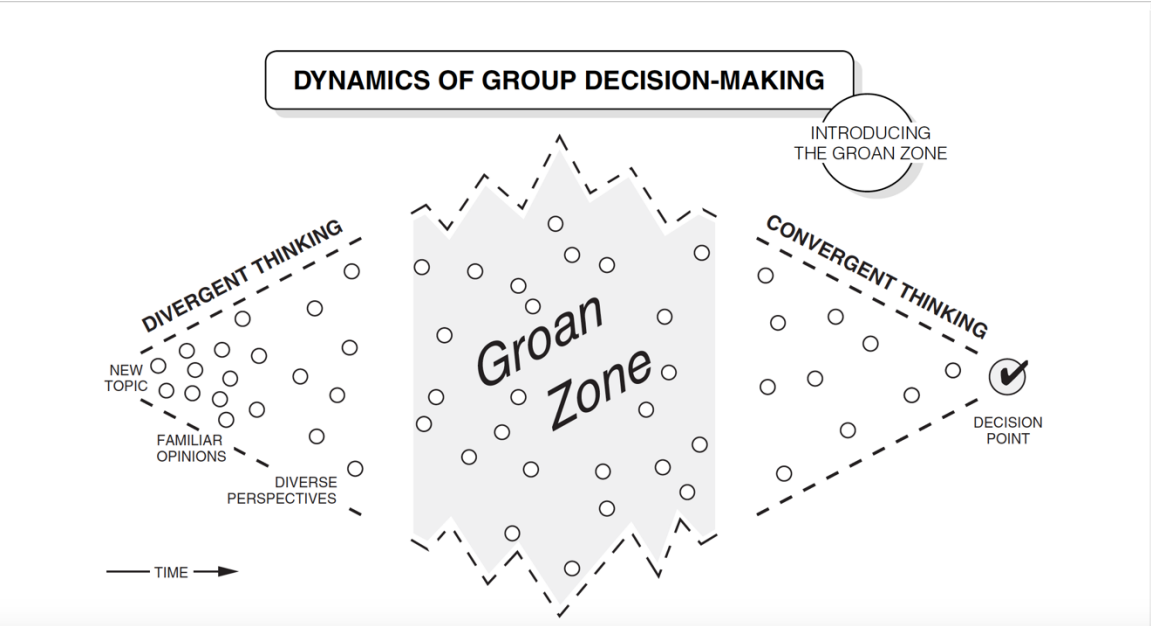


Figure 10. Visualization of the "Dynamics of Group Decision-Making. Illustration from Kaner, 2014.

These selected examples of participatory strategies seek to tackle the tricky issue of aligning multiple people, perspectives, and opinions in order to solve a common problem, be it a decision on how to spend money or how to simply define the problem to begin with. Each of the three examples above includes stages in which stakeholders cooperatively identify the problem, abstract the problem into themes or values, and put forth recommendations to governing bodies (or vice versa, in which governing bodies gather feedback from the public on proposed solutions).

Although participatory democracy frameworks resemble design thinking in many ways, what they often lack are methods for generative ideation and scalable testing, like the ones human-centered design thinking processes have. I believe that in order for cities to make informed and cost-effective decisions on sustainable transportation infrastructure that meets the needs of their residents, these participatory democracy strategies should be

expanded to include other stages in the design thinking process, such as creation, selection, and testing of ideas in order to generate iterative improvements in the built environment.

Participatory strategies regarding sustainable transportation—including observations of human behavior in public spaces, the rapid prototyping techniques of tactical urbanism, and facilitated public engagement to reframe problems—are becoming increasingly citizen-centered. These shifts away from solitary idealized solutions ("visionary planning") and towards collaborative real-word iterations are for cause for celebration, as funding infrastructures for sustainable transportation have and will continue to require local participation and endorsement. As each of these strategies mirrors components and shares goals of design thinking, it is my hypothesis that a combination of participatory strategies with design thinking and practices can help address the demand for, and increase the speed of, investment in healthy, equitable, and cost-effective transportation.

How Design Thinking Can Help

Design thinking, also referred to as human-centered design, originally developed as a concept for rapid innovation in the sectors of engineering and product design in the early 1960s. It continued to expand as a framework for creative problem solving over the decades but saw broader adoption in the 1900s and early 2000s with the establishment of the design firm IDEO and the Stanford d-school. Today, design thinking is commonplace in design curricula, as well as being applied to the fields of business, education, health care, and social services.

There are many toolkits and books that outline design thinking methodologies and steps. One of the most commonly cited examples is Tim Brown's IDEO model, which encompasses three stages: inspiration, ideation, and implementation (Tim Brown 2019, 16). In the inspiration stage teams research, deconstruct, and define the space of a given problem through a host of methods, including interviews, observations, analogous research, and issue framing, to name a few. In the ideation stage, teams use divergent thinking models and abductive reasoning to imagine possible futures and solutions to a problem or problem space (Shearer 2015, 129). Finally, in the implementation stage, teams use convergent thinking to narrow down possibilities based on developed criteria and realistic goals in order to test iterative prototypes.

I believe planners and facilitators can use design thinking methodologies to elicit better public input, because design thinking provides methods to generate ideas, to converge on good ideas, and to rapidly test those ideas. By drawing values and solutions out of everyday human life, design thinking sets the stage for a bottom-up, even more participatory approach to participatory democracy (Kolko 2018).

However, one limitation of design thinking is its organizational overhead. Typical workshops can take many hours to complete, requiring a considerable investment in time on behalf of the team members. And while many of the suggested exercises like those within the IDEO Field Guide are meant to be done quickly and intuitively, the entire process from start to finish can potentially take months. Timelines of this scale can often create impatience and dejection in the public (and among planners).

Additionally, design thinking as a framework has come under fire from critics for being too prescriptive and formulaic in its approach to ideation (Kolko 2018). For the needs of trained designers, this may very well be true, but for the everyday citizen concerned with improving their community, I believe design thinking can be quite helpful in finding solutions. However, it still presents challenges to those who are undergoing the process for the first few times and may find the creative exercises in abductive thinking foreign, jargon-heavy, and esoteric. It takes practice.

For example, during the summer of 2018 UT Design MFA colleague Eric Zimmerman and I worked as design consultants for a federal grant program in Fort Worth, Texas that was seeking to reduce instances of recidivism in recently incarcerated women. The grant, sponsored by the National Center for Mobility Management (NCMM), a program of the Federal Transit Association, facilitated a nine-month design thinking process with My Health, My Resources of Tarrant County (MHMR), an organization that assisted in the rehabilitation of clients with histories of drug abuse, prostitution, and homelessness. Transportation was identified as a key barrier to clients in reaching counseling meetings and court appointments on time, juggling jobs and child daycare, and meeting other appointments like urinary screenings and substance abuse meetings. Clients were not allowed to own a car for the first six months of the program, but most didn't own a car, anyway, prior to being incarcerated.

At the time that Zimmerman and I were brought in as consultants, the team had already completed the first stages of problem definition, empathy, interviews, and theme building, and had done a great job of gather useful insights. It was at the ideation stage, however, when the team, made up of transit operators, program directors, counselors, and public officials, hit a wall. During one of three major workshops facilitated by NCMM, I witnessed first-hand the inability of many members to conceptualize new ideas and build off the ideas of others. It was clear that the team was in the "groan zone". This is the point in the process when designers are especially helpful. Zimmerman and I, who were both more experienced in using design thinking methodologies and in ideation and prototyping, specifically, were able to lead the team out of the groan zone.

In the end, our ability to gain deep insight and empathy through speaking with counselors, clients, and service providers, as well as iterate on solutions with the team was fruitful. Our end product was a transportation-as-a-service platform that provided clients with: a) streamlined ways to get reduced bus fares; b) credits for ride-hailing services to meet monthly required meetings; and c) awareness of bike-sharing as a last mile solution (in addition to providing mental health benefits through exercise, and increased autonomy).

Figure 11. MHMR team during an NCMM design thinking workshop in Fort Worth, TX.

I found the design thinking process was useful when applied to the arena of transportation alternatives. Not only did it highlight the individual barriers in transportation clients were facing in their lives, but also the systemic (car-centric urban planning), contextual (weather, shuttle schedules), and sociological (feeling of safety on late night bus ride) barriers that existed. However, the ideation stage can be a considerable hurdle for many people. Designers skilled in design thinking methodologies—especially ideation and prototyping—can help residents and users co-design more effective systems, products, and services.

CHALKTALK: A DESIGN FRAMEWORK FOR SUSTAINABLE TRANSPORTATION INFRASTRUCTURE

Through design thinking, designers already have a working toolkit to approach wicked problems and find new solutions. Designers are well poised to help cities realize their goals of improving air quality and safety through promoting alternative and sustainable forms of transportation. As I have detailed in this report, building transportation infrastructure can be costly and time consuming, requiring public buy-in on topics that may or may not be relevant to voters. A human-centered approach to infrastructure design can help designers and non-designers alike understand, imagine, and test new facilities to capture this audience and make incremental but positive changes in cost-effective ways.

However, the design thinking toolkit can require large of amounts of time and resource commitments. To make design thinking work as a methodology for planning sustainable transportation infrastructure, it needs to be tailored to the timelines, budgets, and capacities of the people who use that infrastructure, who would ideally be involved in the planning process. That means, among other things, not always doing the design thinking process "from scratch," but rather, drawing on already-available studies and practices. For example, existing public life studies can replace or supplement the "observation" or "embedded research" stages of the design thinking process, and tactical urbanism can substitute for—or already is—the "rapid prototyping" stage of design thinking.

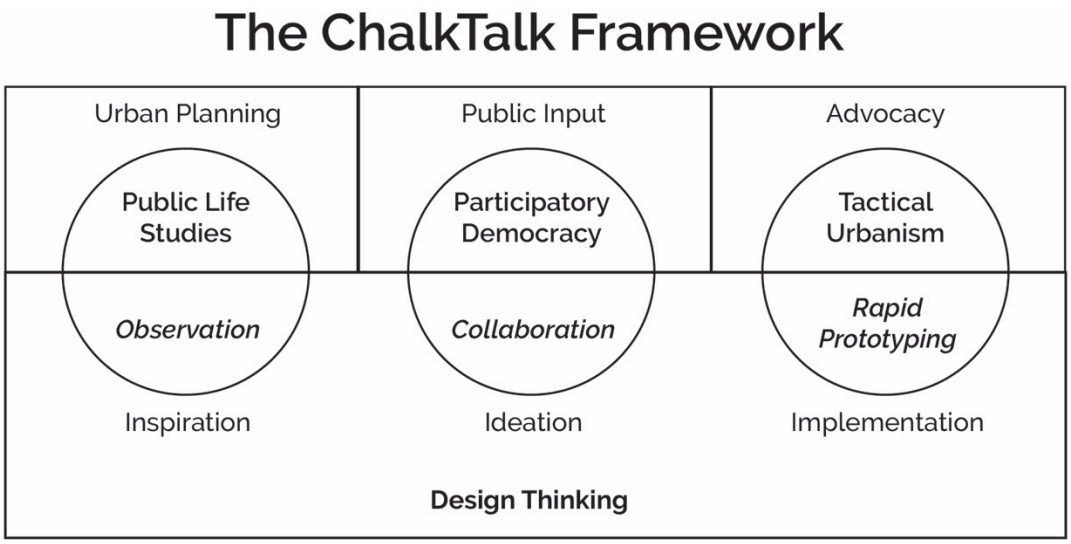


Figure 12. *The ChalkTalk Framework*

PUBLIC LIFE STUDIES AS OBSERVATION

The public life studies pioneered by social activists and architects in the 1960s serve as observation techniques for how the built environment influences human movement. Since transportation infrastructure is directly related to personal safety and a person's chosen mode of travel, it needs to be built with the deep understanding of how, when, and why people move. While transportation data can provide quantifiable information on transportation habits, some techniques of measurement—like that of the American Household Survey mentioned before—can often be incomplete or misrepresentative, leading researchers to hypothesize about what the numbers may mean. Furthermore, since people's commute patterns can also be mostly routine and extrinsic* in nature, personal interviews can at times yield aspirational or unspecific information about the motivating factors behind people's choices in transportation. Unless specifically prompted, people's

* Extrinsic here refers to external factors that influence why people travel, such traveling as a "means to an end" to perform other functions like going to work, shopping for groceries, etc. (Mokhtarian, Slomon, Singer)

awareness of the influence of the built environment invariably ends with a self-admonition of "I should really bike more", with little reflection on the reality that the design of the roads themselves keep them from doing it.

Through observation of public life, the nuances and contexts of travel can be revealed and help fill in the gaps caused through self-reported data. How often have you driven home without a second thought of what route to take? Or walked to the nearest restroom at work using the same consistent path you've always taken? Or followed a worn trail through the grass even though a sidewalk was present? These small adjustments and decisions we make are done absent-mindedly (Kahneman's System 1) and reveal what Don Norman famously described in *The Design of Everyday Things* as "desire lines"—evidence of human work-arounds to failed designs (Norman 2013).

PARTICIPATORY DEMOCRACY AS COLLABORATION

Once insights and problems have been discovered, collaboration can help synthesize these insights into ideas. Participatory democracy and design thinking have a lot in common at this stage. While they both encourage collaboration with diverse people and professions, participatory democracy strategies specifically focus on how infrastructure and policies from a governing body affect everyday people, and how grass-roots organization can in turn influence government action. Most models do not address *how* a group of people can create new ideas or converge onto one idea, which is why there is often a "groan zone" for those involved. This is where Design Thinking can play an important role.

DESIGN THINKING AS IDEATION

Design thinking offers a generative approach for innovating and converging on ideas. However, design thinking as a process can be a considerable undertaking for the public sector and non-profits whose available time and funds may already be stretched thin. Additionally, the ideation stage can be elusive and esoteric for those not trained and practiced in creative thinking. While the divergent/convergent thinking process can help collaborators through the sometimes formless and ambiguous "groan zone", technical and professional assistance is most valuable during this and the next stage of implementation. This creates an opportunity for a participatory design framework where designers, residents, planners, and engineers work together (Sanders and Stapper 2014).

TACTICAL URBANISM AS IMPLEMENTATION

As I've detailed above, infrastructure changes can take large public investments and time to implement. But in design thinking, rapid prototyping is encouraged at almost every stage of the process in order to continually iterate on an idea, and add layers of insight with each stage. Tactical urbanism is an iterative process already being used in the built environment that is comparable to the "rapid prototyping" stage of design thinking; it creates infrastructure using low-cost, temporary materials in a short span of time.

For my master's project, *ChalkTalk,* I adapted traditional design thinking methodologies to work better for wicked problems in the realm of sustainable transportation infrastructure. The *ChalkTalk* framework builds on the foundation of design thinking, and draws on public life studies, participatory democracy, and tactical urbanism methods in order to frame the problem space around publicly-funded built environments and design infrastructures.

The projects below show how I have used this adapted framework to sovle real-world sustainable transportation infrastructure problems. Additionally, I developed design ground rules in response to the lessons learned from these projects in order to help guide future projects in sustainable transportation infrastructure.

Testing the framework

POPUP BIKE RACKS

In collaboration with Big Medium and Love to Ride Austin, I placed temporary pop-up bike racks made from reclaimed wooden pallets around the city in order to encourage non-motorized transportation to and around the East Austin Studio Tour (EAST), demonstrating a cheap and easy way to provide accommodations for bike riders.

Originally this project started as an opportunity to create safer pedestrian environments for event attendees through incentivizing bike ridership. I expected to use a traditional design thinking methodology to partner with Big Medium. I had hoped that we would start with surveys and interviews to understand the transportation choices of attendees, then ideate on possible ways to encourage bike riding, and finally search for low-cost methods to prototype this initiative during EAST.

However, the time and staff costs required to do a full-on design thinking process with Big Medium were prohibitive. After receiving recommendations for other partners from representatives in the Austin Transportation Department, I eventually collaborated with Love To Ride, an international cycling technology company that creates online platforms to encourage ridership. Love To Ride was hosting a one-day bike scavenger hunt during EAST, and needed a way to provide parking for participants that was low-cost and temporary.

Recruiting the help of local designer Orlando Cabanas and his friend Jorge Molina who I met through Park(ing) Day,* we tested designs using the slatted architecture of discarded wooden pallets. We did multiple rounds of testing with both personal and rentable bike frame styles to choose and finalize a bike rack design. The construction consisted of removing or cutting openings in the slats to accommodate a wide variety of wheel sizes and connecting pallets with two standard gate hinges. This allowed the rack to be folded, stacked, and installed easily within minutes. Five racks were installed in locations that had more than one studio as a destination but lacked conventional bike racks.

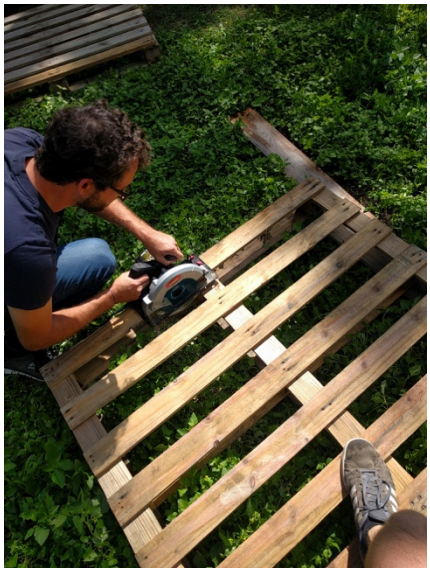


Figure 13. Adapting and testing models for *Popup Bike Racks*.

Turnout for the scavenger hunt was low due to cold, overcast weather that day, but racks were reported to be used by those that participated (I was unfortunately out of town that weekend at a pre-committed event so I wasn't able to observe). The bike racks were left up during the entire two weeks of EAST, beyond the scavenger hunt. When de-

* Park(ing) Day is an event based out of tactical urbanism in which the city encourages the public to create installation in on-street parking space to demonstrate better uses for public streets than holding stationary cars.

installing I received positive feedback from studio owners who remarked on the usefulness of the racks.

Overall, the event taught me that even the most modest undertakings in design thinking can be taxing to small organizations, and that sometimes, finding an expedient solution through an abbreviated design thinking process is much better than finding no solution at all.

Figure 14. *Popup Bike Racks* installed in two of five locations during the 2018 East Austin Studio Tour.

HELLO, MY BIKE'S NAME IS…

During a casual discussion with my cohort I learned that they give their bikes nicknames similar to a pet. Seeing this as an opportunity to introduce new cyclists to the culture of cycling, I created an opportunity for people to share their bike's nickname through social media. Using a typical office white board (because every designer is usually only a few feet away from a whiteboard), I created an oversized name tag akin to the typical

"Hello, My Name Is…" sticker that is distributed at networking events. During the 2018 Park(ing) Day event in Austin, I asked visitors to write their bike names on the board, and pose with their bike, sharing it on Instagram.* If people didn't have a name for their bike, the question would prompt them to consider a name. While the turnout for the event was low, those that participated were enthusiastic about sharing their bike's nickname. This idea evolved into a speculative license plate that cyclists could add to the back of their bike that introduces their bike to car drivers, and in turn humanizes them as riders. Cyclists often feel as if they are less than human by opponents of commuter cycling and aggressive drivers, a theory recently proven by researchers in Australia (Delbosc et al, 2019)

Figure 15. *left.* Participant using *Hello My Bike's Name Is* whiteboard during 2018 Park(ing) Day event in Austin, TX. *right,* Speculative concept for *Hello My Bike's Name Is* "license plate"

* This was not the main focus for the space I was at during the Park(ing) Day event. Five on-street parking spaces were reserved for Bike Austin's intervention demonstrating a separated bike lane. I was volunteering to help with set up and being present.

SCOOTER PARKING

When dockless scooters arrived at The University of Texas at Austin (UT), there was immediate adoption. Like the City of Austin, UT quickly created policy to legalize their usage on the road, but took no further action to manage responsible parking. Using custom stencils and modeling familiar car parking conventions, I created designated scooter parking spots to test whether infrastructure can influence behavior and help manage haphazard parking. At first, I located parking zones near bike racks to align with City of Austin and UT policies. Observing sites both before and after the installation, I found a 25% adoption rate from arriving scooters that increased over time as more commuters learned of its existence. As the benefit of dockless mobility is its door-to-door service, parking spots closest to the main entrance of buildings were used most. Parking spots that were hidden from direct line of sight were less used, even after the addition of a nine-foot sign. However, parking scooter commuters were more likely to use a designated parking zone if it was already inhabited by other scooters. With habitual use, I predicted that scooter commuters would eventually congregate their scooters in these zones.

Surprisingly, the most ardent users of scooter parking were the scooter companies themselves. During an observation, I witnessed a Bird employee actually relocating a number of scooters into the parking zone. I chatted with him and learned that Bird had hired fifty part-time employees for the sole purpose of cleaning up haphazard scooter parking, in an attempt to appease demands from UT and the City of Austin. He mentioned that the presence of designated zones was beneficial as it provided a clear location for the scooter to be deposited and found by future users.

I tested this idea at thirteen sites on campus over a two-month period, including parking zones established during a football game, and shared my insights with UT Parking

and Transportation. They soon implemented campus-wide scooter parking based on these designs in January of 2019.

I also created a strategy to incentivize proper scooter parking through geo-fencing, a technology already in use through scooter company apps like Lime, Bird, and Jump. However, usage of the parking zones on campus after its adoption by Parking and Transportation proved to be successful through observation, as many fewer instances of haphazard parking could be seen while walking through campus, leading me to believe the incentives may not be needed after all.

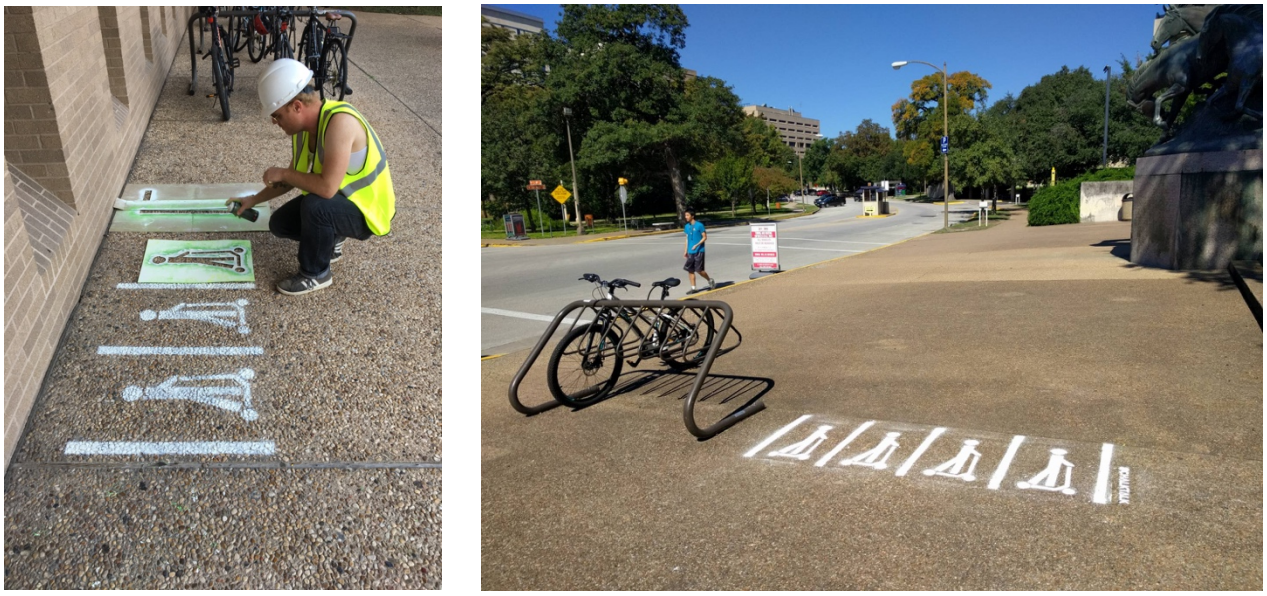


Figure 16. *left*, The author installing *Scooter Parking* iteration using custom stencils and spray chalk outside main entrance of F.L. Winship Drama Building on UT Austin campus. *right*, *Scooter Parking* iteration installed near bike rack at Capital Metro bus stop 2329 on UT Austin campus.

CREATIVE CROSSWALKS

While conducting public life street studies, I observed frequent unsafe mid-block crossings on busy commercial streets. These crossings were occurring between businesses

on opposite sides of the street, but not at intersections where a crosswalk would typically be located. To visualize this activity and to slow down traffic to make it safer for pedestrians to cross, I created whimsical custom crosswalks that responded both to human patterns of movement and the character of their destinations. Using custom laser-cut stencils made from purchased icons from the Noun Project, I collaborated with UT Design MFA colleague Lauren Smedley on ideation and implementation.

The first was located in a commercial strip of Duval St. a mile north of UT Austin. While conducting street studies, I noticed that employees of a local cheese shop were making frequent trips across the road between the shop and tasting room on the other side. This section of the road was especially busy due to cars parking, bike riders in bike lanes, and buses pulling into transit stops. In the middle of the night Smedley and I created a "cheesewalk" using yellow spray chalk and stencils to denote pedestrian movement and hopefully slow traffic by the addition of this public art.

Figure 17. *left*, *Creative Crosswalk* "Cheesewalk" installed on Duval St. in Austin, TX, near Capital Metro bus stop 1262. *right*, detail of stencil artwork.

The reception and use was immediate. The owner of the establishment posted an enthusiastic video to Instagram thanking the anonymous creators and used the #chalktalk hashtag (which was also sprayed on either side of the road as guerilla branding). Observing the new cheesewalk the next day cars did appear to slow down at site of the addition, and bike riders craned their necks, wondering about its application.

The second installation of creative crosswalks was along North Loop Boulevard, a small retail corridor in North Austin with restaurants, bars, and shops. I again witnessed multiple instances of people cross the street between these destinations, some even getting stranded in the middle of the road as they waited for the two-way traffic to subside. Traffic is also notoriously fast on this stretch of road, with two blind corners on either end. Traffic data obtained from the open data portal for the City of Austin show multiple incidents of pedestrian and bicycle crashes along the corridor. Smedley and I installed another crosswalk, between two locally-beloved institutions on either side of the street: a vintage clothing store and sex toy shop. This time we used multi-colored spray chalk in the form of clothes, underwear, condom packages, and sex toys to connect the two establishments. This not only created a form of infrastructure that responded to its environments through placemaking, but did so in a tongue-in-cheek fashion to suggest a narrative of a gender-neutral pair of amorous lovers engaging in safe sex. The crosswalk was installed the night

before Valentine's Day, and posted to Instagram with the affectionate title "Chalk Dirty To Me."

Figure 18. *left*, detail of *Creative Crosswalk* "Chalk Dirty To Me" on North Loop Blvd in Austin, TX. *right*, View looking across North Loop Blvd to Forbidden Fruit sex toy shop.

While there was positive usage of the hashtag on social media, observing the corridor after its installation showed it was ineffective at slowing down traffic or in providing a confident pathway for pedestrian. Even trying it I found myself waiting for a large break in traffic to cross. At one point in the day a semi delivery truck parked in the middle of the road exactly on top of the improvised crosswalks.

These experiments in crosswalks show that much more than surprising street art or surface application may be needed to alert car traffic to the presence of pedestrians, or create confidence in the pedestrians to cross a busy street.

PUBLIC INPUT BOARD

While researching the challenges in gathering and synthesizing public input during the recently abandoned CodeNEXT,* I created a pop-up message board from found materials to convene an asynchronous but collaborative neighborhood meeting.

Parking, mobility, walkability, and neighborhood character were all terms that many residents and neighborhood associations used to voice their concern over proposed parking reductions requirements in CodeNEXT. A reduction in the minimum parking requirement means that the city simply reduces the minimum number of parking spaces required for homes and new development. In recent years high city-mandated minimum parking requirements have been criticized for their promotion of car dependency and inefficient use of land devoted to surface lots and garages (land that could otherwise be activated by other developments) (Shoup 2011). Reducing parking requirements is a way for many cities to encourage density, as well as biking, walking, and transit.

However, this parking proposal in CodeNEXT prompted concerns over the future of neighborhood character for many residents, especially the neighborhood associations that govern them. The terms "neighborhood character" and "walkability" were cited often in position papers submitted to the city and published online, but never clearly defined (City of Austin 2017). To these residents a reduction in parking meant an overflow of cars parked on the street, and thus a negative impact on the character of the neighborhood.

Yet through observation, cars were already parked on the street but people still enjoyed walks in their neighborhood. Additionally, based on an interview with a transportation planner who worked closely on the CodeNEXT process, on-street parking can actually improve walkability and bike-ability as it has a narrowing effect on the road

* CodeNEXT was the land development code rewrite process for Austin, TX. It was abandoned in August 2018 after a six-year process of research, community engagement, and draft revisions due to failure in attaining public confidence and buy-in.

slowing down car traffic. Both audiences in the debate wanted walkability; one saw it as something that needed to be created; one saw it as something that needed to be preserved.

Inspired by private lawn signs, street art, and children's chalk drawings on sidewalks in the neighborhood, I wanted to create an opportunity to collect values, statements, and insights that was inviting, fun, easy and specific to place. A public input board was created using reclaimed wooden pallets, material thrown away from local construction, chalk board paint, and a coffee can. Reusing the same hinged design from the *Popup Bike Racks* above, I installed the board on my own front lawn and posed questions about the neighborhood for people to answer with chalk. Each day I would add these to a temporary *ChalkTalk* Instagram story, sharing the collective but anonymous thoughts of my neighborhood. Wanting to start on a positive note, my first question was "What do you like about this neighborhood?" Many people cited nearby retail businesses, suggesting convenience and proximity were of high value. This also allowed me to "tag" those businesses in social media. Many other people wrote that friendliness and activity on the road were important, in addition to the forms of the homes. Once the board was full, I

erased it and reset it with a new question. A documentation of input for each question can be found at http://Instagram.com/Chalk.Talk.To.Me.

Figure 19. *left*, Skeletal structure of *Public Input Board* made from reclaimed wooden pallets. *right*, Installation of *Public Input Board* in front of author's residence in Hancock Neighborhood in Austin, TX.

In an age of divisive internet culture, the public input board demonstrated community thinking and collective input in a human way. People's personal handwriting styles are evident, and as the board filled up with answers, people began to sketch and draw in the allotted space. Some even took to "like" others' answers by underlining, circling or drawing arrows. The board was met favorably with those who used it, and even more were intrigued by its presence. It stands as a low-cost, temporary, and modular way to engage the public on elusive topics that are specific to place and context.

Figure 20. *left*, *Public Input Board* answers from community for question "What do you like about this neighborhood?" *right*, *Public Input Board* answers from community for question "What does this neighborhood need?"

Ground Rules for Approaching Projects in Sustainable Transportation Infrastructure

Through these experiments I was able to develop ground rules that helped guide the projects through challenges and ambiguity and come up with innovative, forms of infrastructure that serve as critical interventions in the built environment.

MAKE IT PERSONAL

Since traditional models of public input and buy-in tend to fail at demonstrating the benefits to public audience, designers and planners should work in tandem to produce material or interventions that respond to human use. In the case of CodeNEXT, many residents could not see the positive impacts that land code changes could have on their neighborhood streets. While it's impossible to cater to every city resident individually, a human-centered approach to understanding how infrastructure influences people's daily lives can aid in attaining public buy-in for funding and use. Furthermore, people who see themselves in the final solution are more likely to be invested in its success.

RESPOND TO PLACE

Allowing infrastructure to respond to the culture, context, histories, and/or human usage of a given street, neighborhood, or district can create unique and memorable moments of ownership. The augmented "rhino" bike lane stencil seen in Denver, or street art injected into otherwise banal crosswalks, can activate the space, spark co-designed, customized solutions, and increase public investment. This adaptability can also yield more environmentally friendly results by encouraging "slow" transportation.

BUILD UPON WHAT EXISTS

To achieve major shifts in commuting behavior, incremental changes must be made to resist resistance due to culture change, fear of the unknown. In the case of *Hello, My Bikes Name Is…*, the end result became a combination of a license plate and a name tag sticker. For *Scooter Parking* a well-established norm of vehicle parking zones already existed. Augmenting these norms to fit the size and intended use yields a new solution that doesn't require education or explanation. In addition, observation of public life often reveals informal "work-arounds" and interactive behaviors with space that are creative and inspirational, and that can be used as models for more permanent solutions.

SHOW DON'T TELL

This is the trickiest ground rule to follow, but designers are well trained to do it. The disciplines of transportation and urban planning tend to be heavy with jargon, technical terms, and statistics. By translating abstract concepts or projects into concrete visual, auditory, or tactile interventions, people can grasp the nature and scope of the problem better.

These ground rules not only serve to guide the development of sustainable transportation infrastructure and how it is talked about, but to also reframe projects to suit human needs.

The ChalkTalk Booklet

One component of my thesis project is the *ChalkTalk* booklet, a grass-roots toolkit that uses the *ChalkTalk* framework to educate and empower the public about sustainable transportation options, promote participatory design between cities and neighborhoods, and utilize cost-effective rapid prototyping to test innovative solutions in sustainable transportation infrastructure. Since design thinking workshops tend to be exclusive to large institutions and require a lot of time, I wanted to find more personal and digestible ways to encourage participation in and comprehension of the way cities are built for their residents. I chose a booklet form because I found that as I was using the *ChalkTalk* framework outlined above, I took notes, sketched ideas, and documented my findings through simple pencil and paper. This not only created a physical archive for my work, but helped me visualize tangible solutions.

At the time of this writing I am testing my prototype of this booklet. During my collaborative MFA Design Exhibition, *Work For Progress*, I showcased the five projects above, their impact and material, and distributed *ChalkTalk* booklets to the public. Instead of asking them to send these booklets to public officials, I instead included my home address so that I may gather and analyze their contributions. I also asked those who took a booklet to mark their neighborhood on hand-drawn map on the wall. This served as visualization of where these booklets were being distributed.

Figure 21. *ChalkTalk* exhibition featuring sample projects and booklet distribution wall.

Figure 22. Booklet distribution wall from *ChalkTalk* exhibition.

Figure 23. Detail of project wall.

The booklet can be used by designers, planners, or residents not in these fields. The booklet utilizes only black ink, and is formatted on standard 8.5 × 11 sheets of paper, making it easy to print from home or a public printer. Sheets are then folded in half lengthwise and assembled into a booklet. There are five main sections that walk the user through the following five steps of the process.

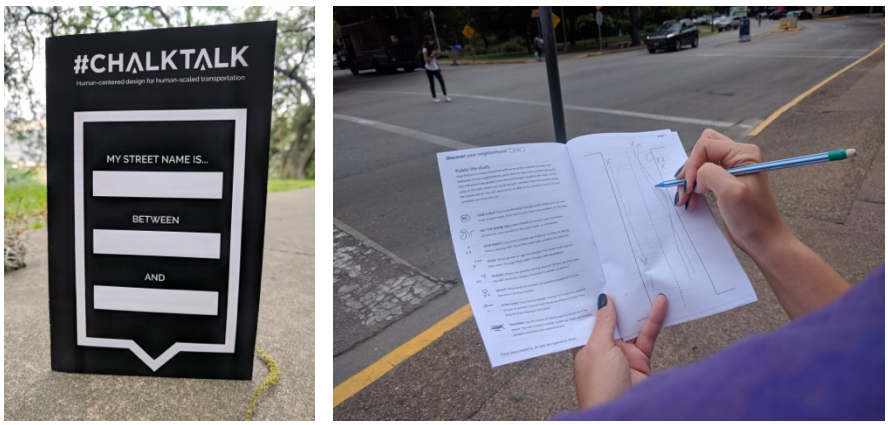
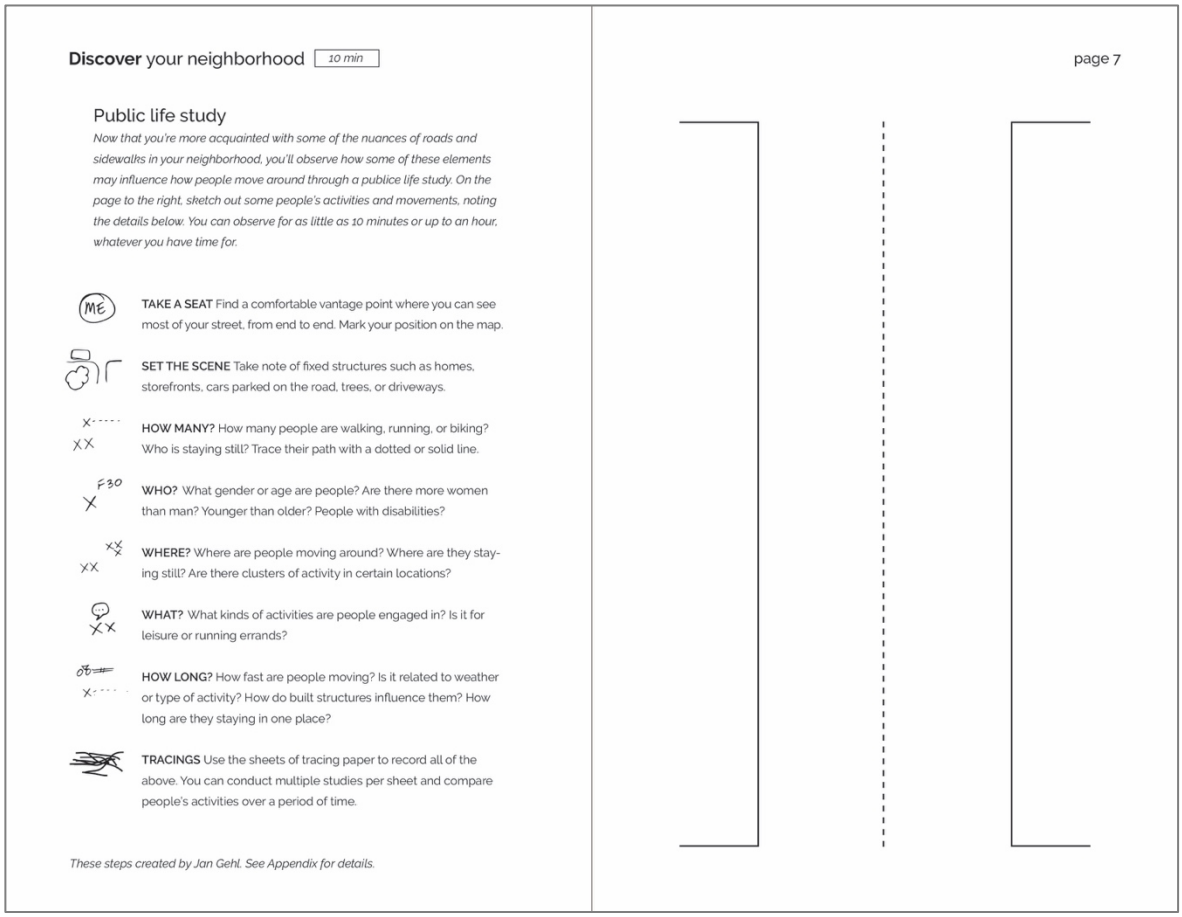


Figure 24. *left*, *ChalkTalk* booklet. *right*, UT Design MFA candidate Lauren Smedley using the Observation section.

OBSERVING

The user is encouraged to observe a neighborhood street through two methods. The first is a pedestrian walk audit, developed by Dr. Kelly J. Clifton, Dr. Andrea D. Livi Smith, and Dr. Daniel Rodriguez as part of their Pedestrian Environment Data Scan (Clifton, Smith, and Rodriguez 2007, 98). This tool is often used by urban and transportation planners to objectively assess the quality of a given stretch of road through the experience of a pedestrian. Amenities such as benches, bus stops, shade, vegetation are recorded, as well as barriers such as telephone poles, fire hydrants, and driveways. The character of the road is also recorded to assess the material and continuity of a sidewalk (if one is present at all), the incline of the road, and general comfort while walking. I chose to include this

tool as a first step because I found it surprising how many artifacts I took for granted that ultimately influenced my movement. The tool is objective but extremely effective at forcing the user to look at infrastructure with a critical eye.



Discover your neighborhood 10 min

Public life study

Now that you're more acquainted with some of the nuances of roads and sidewalks in your neighborhood, you'll observe how some of these elements may influence how people move around through a publice life study. On the page to the right, sketch out some people's activities and movements, noting the details below. You can observe for as little as 10 minutes or up to an hour, whatever you have time for.

TAKE A SEAT Find a comfortable vantage point where you can see most of your street, from end to end. Mark your position on the map.

SET THE SCENE Take note of fixed structures such as homes, storefronts, cars parked on the road, trees, or driveways.

HOW MANY? How many people are walking, running, or biking? Who is staying still? Trace their path with a dotted or solid line.

WHO? What gender or age are people? Are there more women than man? Younger than older? People with disabilities?

WHERE? Where are people moving around? Where are they staying still? Are there clusters of activity in certain locations?

WHAT? What kinds of activities are people engaged in? Is it for leisure or running errands?

HOW LONG? How fast are people moving? Is it related to weather or type of activity? How do built structures influence them? How long are they staying in one place?

TRACINGS Use the sheets of tracing paper to record all of the above. You can conduct multiple studies per sheet and compare people's activities over a period of time.

These steps created by Jan Gehl. See Appendix for details.

page 7

Figure 25. *ChalkTalk* booklet "Discover" spread

The second part is a public life study, inspired by Jan Gehl and his pioneering work in understanding urban space. Gehl used public life studies as a way to measure human movement through and between built environments by documenting and quantifying observed characteristics. By providing a generic overhead diagram of a street, users are asked to observe a block from single vantage point and record how people move using the

qualifiers of How Many, Who, Where, What, and How Long (Gehl). This activity is intended to shed light on how infrastructure studied in the walk audit in the previous activity influences human movement.

UNDERSTANDING

This stage guides the user to synthesize what was recorded in the Observation stage into insights and themes. This is a necessary step in not only discovering problems but also to process what they observed. Writing in pedagogy and the science of learning shows that recall and reflection is an important step in constructing one's learning (McKeachie 2013). So before the user dives into solution-finding (which is the fun part that everyone wants to do immediately!), they are first forced to deconstruct surface-level observations to find motivating factors behind movements. Analysis and synthesis are also important steps in design, and this is where laypeople may find themselves in esoteric territory. By providing boxes and specific prompts in clear language, the user can develop deeper themes from which to ideate.

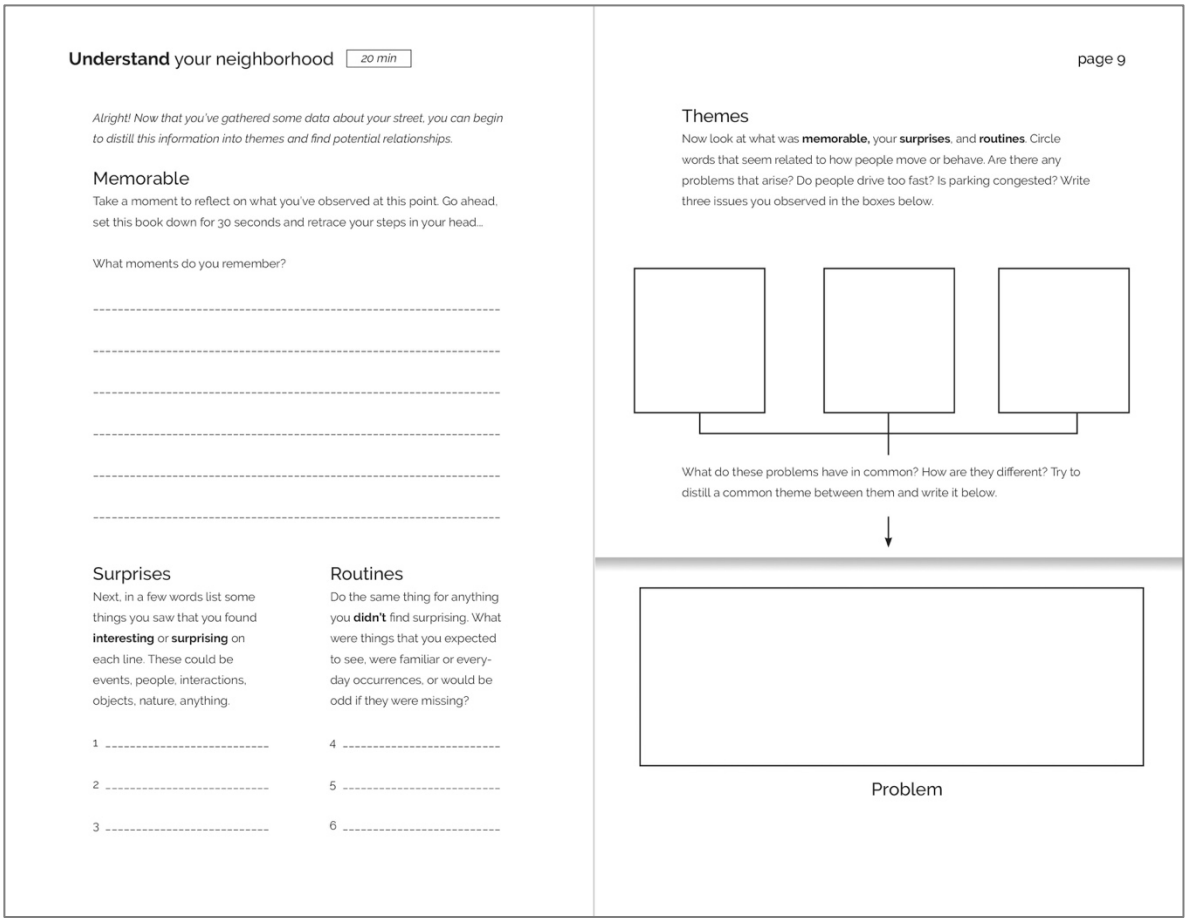


Figure 26. *ChalkTalk* booklet "Understand" spread

IMAGINING

This is the fun part, but also the hardest. As I have found in my research, creative thinking can be a barrier for non-designers, and it is this stage that earned the moniker of "the groan zone" by Kaner. This section is comprised of three separate spreads, two pages of which are cut in half. The half sheets allow for the reverse page to reference what was written on the previous pages, connecting the stages of Understanding and Imagining. This serves two goals: 1) to save time as it builds off what is already written, removing the need

to rewrite; and 2) forcing the user to work quickly. As a designer, it is easy to linger in this ideation stage, always imagining what could be and dreaming up new ideas. The half sheets serve as a mechanism to move on, work quickly, and not deliberate overlong on ideas. Design thinking toolkits (like those created by IDEO) suggest never to be too precious with ideas, and test them early, so these spreads on imagining solutions ask the user to trust their gut instinct.

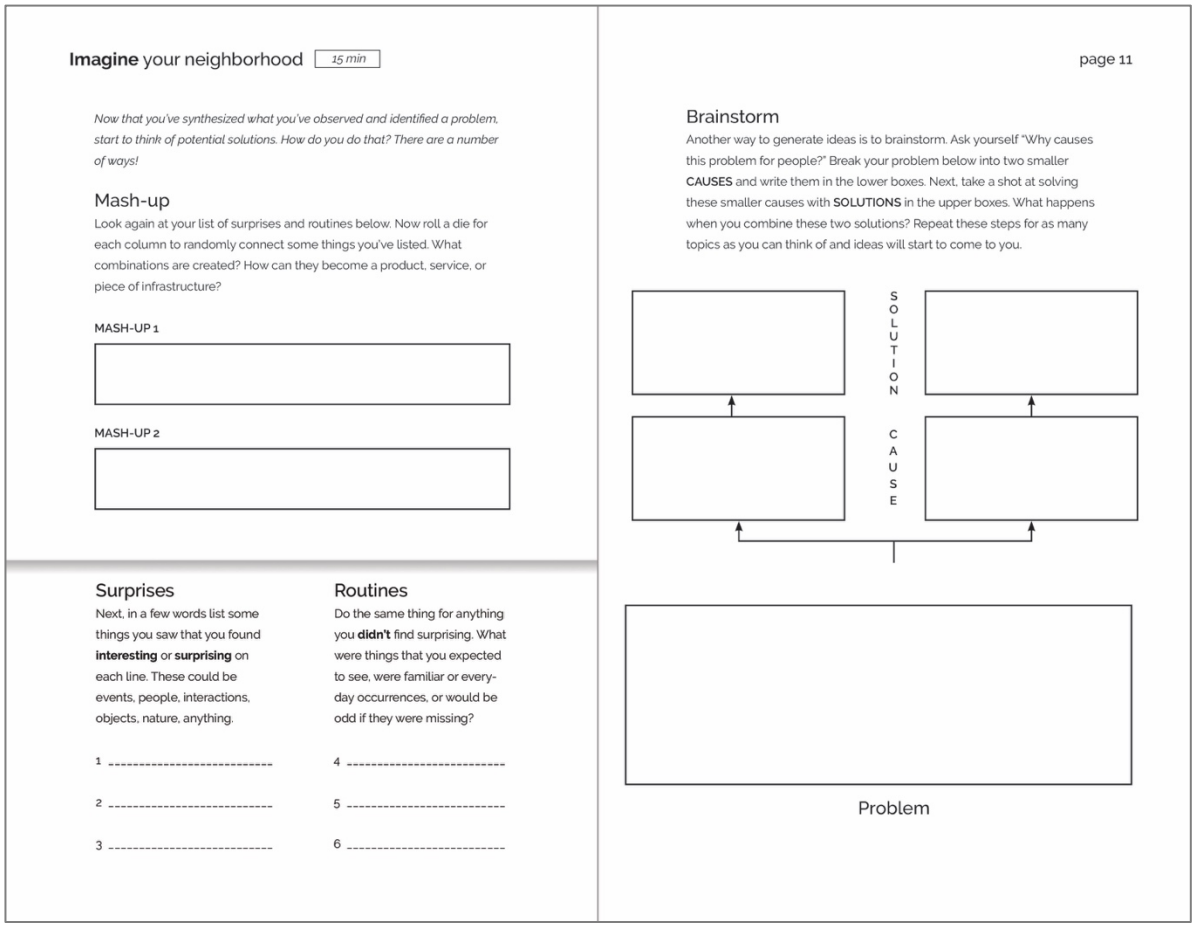


Figure 27. *ChalkTalk* booklet "Imagine" spread

The first Imagining spread offers tools to process themes from Understanding, like creative mashups and brainstorming. The second spread asks the user to write down three ideas, detailing what they will do and for whom, and rate them on a rubric of feasibility (is the idea doable?), value (will the idea help people?), and affordability (is the idea cheap to make?). Ideas that meet the most criteria move to the last spread, where they are storyboarded to consider their entire lifecycle.

IMPROVING

This stage asks the user to break down their idea into a list of materials and provides suggestions for resources they may already have in their home like duct tape and cable ties. It also provides tips on where to find retail stores or dumpsters to find materials to use in creating quick low-fidelity prototypes.

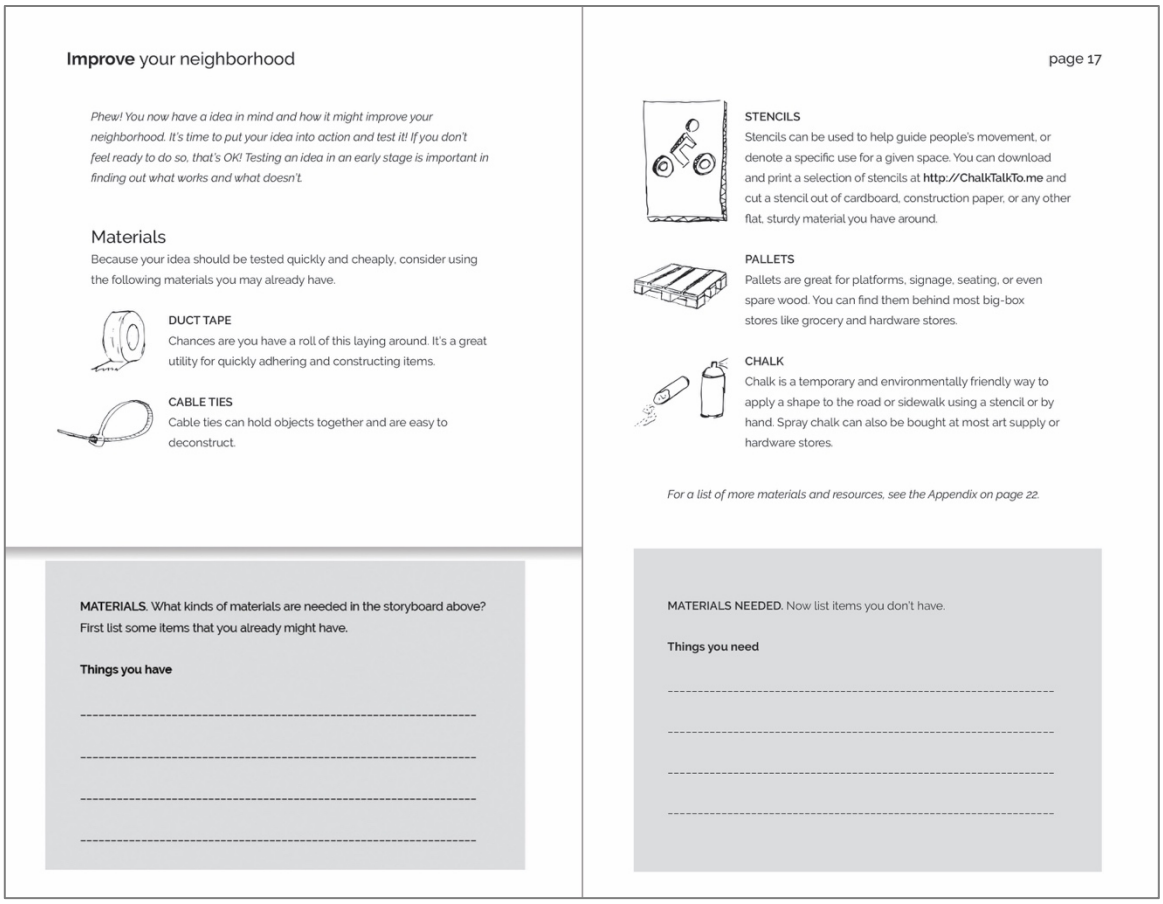


Figure 28. *ChalkTalk* booklet "Improve" spread

The user is then encouraged to test their idea on a small scale and observe the effects the same way they conducted the public life study. This is using tactical urbanism as a method for rapid prototyping.

SHARING

Finally, the user is encouraged to share their idea with an official with the city. A list of possible offices and departments to contact is provided, such transportation, public works, or parks and recreation. The act of sharing opens up dialogue between residents and

the city in a meaningful and substantive way. The city staff also receives a wealth of qualitative information that lays the groundwork for meaningful collaboration. The Sharing stage also includes social media accounts and hashtags for *ChalkTalk,* encouraging users to share their project.

Share your neighborhood

Wow! You've successfully observed a problem, created a possible solution, and tested it out in the real world! Chances are another community is experiencing the same issues you've observed in yours. At this point you should share your initial findings with other to test it more, or see what other ideas can be built from it.

Social Media

Take photos of your idea in action and share it to your personal social media account of choice. Use the hashtag below and tag **@chalk.talk.to.me** so others doing their own ChalkTalk can see your idea and build upon it.

USE THE HASHTAG → #ChalkTalk

TAG ON TWITTER & INSTAGRAM → @chalk.talk.to.me

Invite Feedback

There are many ways to gather feedback from the people using your idea. This can be in the form of a message board, allowing people to edit your idea, or creating your own hashtag. See more examples of feedback at **http://ChalkTalkTo.me.**

What are ways that people interact with or touch your idea?

How can this interaction be used for feedback?

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page 21

Local city officials

In addition to your social media, share your idea along with any images you took with your city officials. You will provide them with a rich set of qualitative data that will help them improve yours and other neighborhoods. The best part is it started with **you.**

Depending on your city there could be several city offices that would be relevant to your idea.

PUBLIC WORKS

Public works departments generally design and oversee major projects in city infrastructure.

TRANSPORTATION

Transportation departments focus on facilities for types of traffic, commuter safety, and maintenance of roads.

PARKS AND RECREATION

As the name implies, Parks and Recreation departments focus on public land for leisure and activity.

NEIGHBORHOOD PARTNERSHIP PROGRAMS

Some cities even have Neighborhood Partnership Programs, in which ideas like yours can be implemented on larger scales.

CITY COUNCIL

Whether your City Council is at-large or ward based, an elected council person has a vested interest in grassroots ideas.

Use this sticker to bind your booklet before mailing →

Figure 29. *ChalkTalk* booklet "Share" spread

By collecting projects posted through social media and exhibiting them on a website (http://chalktalk.to.me), I plan to demonstrate how design can help cities build

sustainable transportation infrastructure, and provide a repository for firsthand insights, innovative solutions, and research for planners and engineers working in this discipline.

Next steps, areas of improvement, and gaps in research

When I discussed the idea for my *ChalkTalk* booklet with professors in design, urban planning, and facilitation, they recommended that a city professional be brought in earlier in the process, perhaps in the Imagine stage, when users ideate toward solutions. This would allow for increased participatory design and co-creation of solutions between city and resident, but would also ease the city's concerns about liability when solutions are tested through tactical urbanism.

I imagine several different processes and approaches in continuing *ChalkTalk*, and my next iteration of the booklet will encourage residents to hold a block party or neighborhood meeting in which they invite city officials for work session.

To further develop *ChalkTalk* into a viable framework for cities, neighborhoods, and advocacy groups working in the realm of sustainable transportation infrastructure, I plan to continue my research into the subject of participatory democracy, public facilitation, and models for participatory design. I have learned that one of the biggest hurdles most city leaders and staff face is effectively communicating and engaging with their residents. This can be as simple as clearly conveying an idea, or as challenging as engaging and empowering those that already mistrust government systems. Utilizing generative frameworks of design in combination with emerging collaborative techniques, I believe, will aid in creating shared solutions on the infrastructure that impacts us all.

Conclusion

I entered the Design MFA program seeking to find ways designers can help cities increase their participation in commuter cycling. Through academic studies, cultural immersion, and practical applications of iterative solutions, I have been able to broaden my understanding of the contexts that surround commuter cycling. Of course, when working within the institutions of government systems, policies, and funding, it is easy to get lost in the interweaving threads that influence such a specific topic, such as urban sprawl, affordable housing, gentrification, public/private relationships, and so on. However, I am confident that the *ChalkTalk* framework can help designers better collaborate with city officials and residents, consider these complex networks of contexts, and find more innovative solutions to improve the built environment.

Ultimately, I see *ChalkTalk* functioning in two ways: first, as a framework for designing sustainable transportation infrastructure, and second, as a social media and physical brand that is defined by the people that utilize the framework. The *ChalkTalk* identity is built to be recognizable, yet still flexible enough to accommodate the unique characteristics that define a neighborhood, district, or city. I hope to continue testing my framework with diverse localized problems, and encourage its future use by others who are interested or concerned with how cities are built, used, and evolve.

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